REVERSAL PROCESSES IN ION-IRRADIATION PATTERNED CO/PT MULTILAYERS.

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Abstract

(111) textured $(Co_{0.3nm}/Pt_{1nm})_{10}$ multilayers with perpendicular anisotropy were grown on electron transparent SiN windows using electron beam evaporation. These multilayers were patterned into magnetic sub-micron arrays by ion beam irradiation through a stencil mask and by a direct Ga Focused Ion Beam writing. Two complementary electron and photon magnetic imaging techniques were utilized to study the reversal processes of the patterned magnetic arrays. Lorentz transmission electron microscopy, sensitive to the in-plane magnetization, revealed magnetically soft ion-irradiated areas. X-ray transmission microscope at the Advanced Light Source, utilizing element specificity (Co L_3 absorption edge) and magnetic contrast due to magnetic circular dichroism (MCD), was used to image the reversal of perpendicular magnetization with a 25 nanometer resolution. Samples imaged at remanance, after saturation in a polar direction, showed significant decrease in intensity for irradiated regions as a result of the change of the easy axis of magnetization from out of plane to in plane. The same area imaged at 750eV, (off the Co edge), showed no contrast indicating no topographical changes due to the patterning. Reversing the applied field direction resulted in partial switching of the un-irradiated areas at fields below the sample coercivity ($H_{C\perp}$ = 6.3kOe). The reversal originated at the edges of the patterns and propagated into the non-irradiated surrounding regions. Details of the magnetizing experiment including the reversal mechanism for the samples exposed to different irradiation doses are discussed in the paper. These results are correlated with the microstructure, which was investigated using conventional, high resolution and energy filtered transmission electron microscopy (TEM).